REMARKS

Entry of the foregoing, and re-examination and reconsideration of the subject application, in view of the amendment above and the remarks which follow, are respectfully requested.

By the above amendment, new claim 23 has been added. Thus, upon entry of the foregoing amendment, claims 1-23 will be pending in the application. Each of these claims is under consideration.

Prior to discussing the substance of the Official Action, Applicants would like to extend their appreciation to Examiner Chaudhry for the courteous personal interview conducted with the undersigned on March 19, 2002. The Interview Summary adequately reflects the substance of the interview. Although, in addition to what was reported, the Examiner also invited Applicants to resubmit arguments regarding the appropriateness of the combination between *Fache et al* and *BE '237* because they involve different methods for preparing adipic acid which would necessarily produce different reaction products which would have to be considered when carrying out their purification.

In the Official Action, claims 1-10, 13-15, and 19-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Fache et al* (U.S. Patent No. 5,900,506) in view of *BE '237* (BE 855237A). Claims 16-18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Fache et al* in view of *BE '237*, and further in view of both *JP '802* (JP71002802B) and *JP '975* (JP81006975B). Claims 11-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Fache et al* in view of *BE '237*, and further in

view of *Dougherty et al* (U.S. Patent No. 3,933,930). For the reasons set forth below, these rejections should be withdrawn.

The present invention, as defined by claim 1, relates to a process for treating the reaction mixture resulting from the direct oxidation of cyclohexane to adipic acid with molecular oxygen in an organic solvent in the presence of a catalyst. The process comprises the steps of (a) separating the reaction mixture into two liquid phases by settling to form an upper phase comprising cyclohexane, and a lower phase comprising an organic solvent, diacids formed during the oxidation reaction, a catalyst and a portion of other reaction products and unconverted cyclohexane; (b) distilling the lower phase to provide (i) a distillate comprising at least a portion of the most volatile compounds and (ii) a distillation bottoms comprising the diacids formed and the catalyst; (c) separating the catalyst from the distillation bottoms; (d) conducting a reducing and/or oxidizing purification treatment of the adipic acid in an aqueous solution; (e) crystallizing the adipic acid from water, preceding or following purification step (d), if crystallization has not been carried out in order to separate the catalyst from the distillation bottoms; and (f) recrystallizing the adipic acid from water.

Fache et al discloses a method of processing reaction mixtures obtained from the oxidation of cyclohexane. The method of *Fache et al* comprises three primary steps: distillation; addition of water; and crystallization.

The present invention is an improvement to the process disclosed by *Fache et al*. This improvement can provide adipic acid in high purity and with good coloration.

Fache et al does not disclose or suggest each of the features of the presently claimed invention. For example, *Fache et al* does not disclose or suggest step (d), conducting a reducing and/or oxidizing purification treatment of the adipic acid in an aqueous solution. This purification step can take the form of hydrogenation and/or treatment with nitric acid and/or oxidation using molecular oxygen, ozone or hydroperoxide. See, e.g., claim 10 and the specification at page 8, line 5 to page 10, line 16. Thus, *Fache et al* clearly fails to disclose or suggest each of the features of the presently claimed invention.

BE '237 does not remedy the deficiencies of *Fache et al*. *BE '237* discloses a combination of two treatments for purifying adipic acid. One is treatment with nitric acid, and one with activated charcoal. The adipic acid is obtained by oxidation of cyclohexane with nitric acid.

***BE '237* cannot be properly combined with *Fache et al*.** The reaction mixture of *Fache et al* is obtained by direct oxidation of cyclohexane with oxygen in an organic solvent and in the presence of a catalyst. In contrast, as mentioned above, the reaction mixture of *BE '237* is obtained by oxidation of cyclohexane with nitric acid. The two reactions are quite different and yield different reaction mixtures. For example, oxidation by nitric acid produces various nitrous compounds while oxidation by oxygen does not. See, e.g., *Fache et al* at col. 1, lines 11-17. Moreover, the catalyst used in nitric oxidation is different from the catalyst used in direct oxygen oxidation. As a result, it would not have been obvious for one of ordinary skill in the art to combine the teachings of *BE '237* with those of *Fache et al*, as hypothesized in the Official Action, because the reaction

mixtures in each are different and contain different components/impurities which would have to be taken into account when conducting the purification of adipic acid obtained from each process.

New claim 23 further differs from *BE '237* in that it does not require a second treatment step with activated carbon. In this connection, Applicants are attaching herewith a copy of GB 1,576,297 ("*GB '297*") which, based on the English abstract of *BE '237*, corresponds to *BE '237*. At page 2, lines 4-7 and lines 16-19 of *GB '297*, it is clear that the process described in the English abstract of *BE '237* requires a second step involving the use of activated carbon. In contrast, claim 23 does not. Accordingly, new claim 23 further distinguishes from the applied references.

Since the rejection of claims 11-12 and the rejection of claims 16-18 are both premised on the combination of *Fache et al* in view of *BE '237*, they are improper for at least the same reasons that the rejection of claims 1-10, 13-15, and 19-20 is improper.

Accordingly, for at least all of the reasons set forth above, the applied references cannot be properly combined to disclose or suggest each of the features of the presently claimed invention. Therefore, there is no *prima facie* case of obviousness, and the rejections under 35 U.S.C. § 103(a) should be withdrawn.

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order, and such action is earnestly solicited.

If the Examiner has any questions concerning this Reply, or the application in general, the Examiner is invited to telephone the undersigned at the number listed below.

Respectfully submitted,

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MARKED-UP VERSION OF AMENDED CLAIMS 1, 5, 12, 14, AND 15

1. **(Twice Amended)** A process for [the treatment of] treating the reaction mixture resulting from the direct oxidation of cyclohexane to adipic acid [by] with molecular oxygen in an organic solvent in the presence of a catalyst, said process [comprises] comprising:

[-] (a) separating the reaction mixture into two liquid phases by settling[:] to form an upper phase comprising cyclohexane, and a lower phase[,] comprising an organic solvent, [the] diacids formed during the oxidation reaction, a catalyst and a portion of other reaction products and unconverted cyclohexane;

[-] (b) distilling said lower phase [, making it possible to separate, on the one hand,] to provide (i) a distillate comprising at least a portion of the most volatile compounds [comprising the organic solvent, and/or water, as well as unconverted cyclohexane, cyclohexanone, cyclohexanol, cyclohexyl esters and lactones,] and [, on the other hand, the] (ii) a distillation bottoms comprising the diacids formed and the catalyst;

[-] (c) separating the catalyst from the distillation bottoms [obtained above, either by crystallization from water, by electrodialysis or by passing over an ion-exchange resin, after dissolution of said distillation bottoms in water, or alternatively by washing with water or by liquid-liquid extraction];

[-] (d) conducting a reducing and/or oxidizing purification treatment of the adipic acid in an aqueous solution;

[-] (e) crystallizing the adipic acid from water, preceding or following [the] purification step (d), [treatment, when the] if crystallization has not been carried out in order to separate the catalyst from the distillation bottoms; and

[-] (f) [recrystallization of] recrystallizing the adipic acid from water.

5. **(Twice Amended)** The process according to claim 1, wherein the stage of distillation of the lower phase is carried out so that [most of] the unconverted cyclohexane still present in this lower phase and [of] the solvent [is] are separated from the adipic acid.

12. **(Twice Amended)** The process according to claim 10, wherein the catalyst comprises at least one metal from group VIII of the Periodic [Classification of the] Table of Elements, optionally deposited on a solid support.

14. **(Twice Amended)** The process according to claim 13, wherein the treatment with nitric acid is carried out by heating the mixture at a temperature of 25°C to 120°C [for a period of time of a few minutes to a few hours].

15. **(Twice Amended)** The process according to claim 13, wherein the treatment with nitric acid is carried out [in the absence of catalyst or] in the presence of a catalyst comprising one or more cobalt, copper and/or vanadium compounds.